REMARKS

In the patent application, claims 1-21 are pending. In the office action, all pending claims are rejected.

Applicant has amended independent claims 1, 5, 12 and 17.

Claims 1, 5, 12 and 17 have been amended to include the further limitations that each of the apertures has a step-like recess and each of the membrane electrode assembly segments is attached in the recess of one aperture so that each membrane electrode assembly segment can be independently and separately replaced if needed.

The support for the amendment can be found on page 6, lines 21-23; Figures 4a and 4b; page 8, lines 16-17.

No new matter has been introduced.

At section 3 of the office action, claims 1, 5-10 and 12 -20 are rejected under 35 U.S.C. 102(b) as being anticipated by *Fujii et al.* (WO 02/080299, hereafter referred to as *Fujii*).

In rejecting these claims, the Examiner states that *Fujii* discloses a fuel cell comprising a planar substrate 11 having a plurality of apertures 16 with a plurality of membrane electrode assembly segments 12/13/14 securely attached on the apertures 16.

Applicant respectfully disagrees.

Fujii discloses a fuel cell made by a semiconductor process (see Abstract). As shown in Figure 1, the fuel cell has a substrate 11 with a plurality of openings 16, and an MEA is formed so as to cover each of the openings. The MEA comprises a laminate of a first catalyst electrode 12, a hydrogen ion conductive polymer thin-film membrane 13 and a second catalyst electrode layer 14 (col.5, lines 11-17). Functionally, the MEA 12/13/14, according to *Fujii*, is equivalent to the MEA segment 110 of the present invention; the membrane 13 is equivalent to the PEM 120; and first catalyst electrode 12 and the second catalyst electrode 14 is equivalent to the first and second activation layers 112 and 114 of the claimed invention.

However, the claimed invention is distinguishable over *Fujii* for a number of reasons:

1) the aperture of the claimed invention has a step-like recess so as to accommodate one MEA segment; and

2) each of the MEA segments is attached in the recess of one aperture so that it can be independently and separately replaced if needed.

Fujii fails to disclose those features: First, in *Fujii*, the MEA is formed in a number of separate processes (see Figures 3b-3e). The first catalyst electrode layer 12 is formed on the front surface of the Si substrate by a sputtering process (col.5, lines 35-37) and then the membrane 13 is formed by a spin coating process (col.5, lines 44-54). Subsequently, the second catalyst electrode layer 14 is formed by a sputtering process (col.5, lines 55-57). After the formation of these layers, the Si substrate is etched to form the openings 16 (col.5, line 63-66). Since the layers 12/13/14 are formed on the front surface, the openings must be etched through the second surface up to the mask layer 17 (see Figures 3c and 3d). As such, there is no step-like recess on the front surface for each opening.

Second, after the openings are etched out, the mask layer 17 is removed by sputter etching or reactive ion etching (col.6, lines 1-9). In the fuel cell, according to *Fujii*, if one of the MEA segment becomes defective, it cannot be independently and separately replaced. That is because the opening under the defective MEA segment has been formed in the substrate, no support is available for the forming of the first catalyst electrode layer 12 by sputtering, the membrane layer 13 by spin coating and the second catalyst layer 14 by sputtering.

Accordingly, *Fujii* fails to disclose the limitations in independent claims 1, 5, 12 and 17.

For the above reasons, *Fujii* fails to anticipate claims 1, 5-10 and 12 –20.

At section 5, claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Fujii*, in view of *Nagayama* (JP11045729A). The Examiner cites *Nagayama* for disclosing a hot melt layer for adhering various layers in a fuel cell. The Examiner states that it would be obvious for a person skilled in the art to combine the teachings of *Fujii* and *Nagayama* to come up with the invention of claim 2.

Applicant respectfully disagrees.

Fujii uses various coating processes to form the membrane electrode assembly segments on a silicon wafer. It is known in the industries that the silicon wafer must be thoroughly cleaned so that the mask layer 17, such as a silicon nitride film can form by the reaction of silicon and the dichlorosilane and ammonia provided in the chemical vapor deposition process (col.5, lines 23-29). With a hot melt layer, according to *Nagayama*, on the silicon surface, no such reaction can occur.

Even if the hot melt layer is applied on top of the mask layer 17, it is not practical, if not impossible, to form a stable and even first catalyst electrode layer of Pt-Ru alloy having a thickness of 0.01 to 0.05 micron on top of the hot melt layer. Furthermore, after the openings are etched out from the second surface of the silicon wafer and the mask layer 17 within the openings is removed, it is not known how the hot melt layer can be removed without damaging the MEA segment itself.

In general, a hot melt material is a polymer. In order to avoid possible undesirable reactions between the hot melt material and the raw materials in the chemical vapor deposition process, one must study the chemical properties of the hot melt material. Furthermore, *Fujii* discloses a method for producing a micro-scale fuel cell wherein the electrode area of each unit cell is 1 mm^2 (col.6, lines 22-23) and various layers are formed in the 0.01 to 0.05 micron range (mask 17, first and second electrode layers 12, 14). In order to introduce hot melt material into a micro-scale fuel cell, should one also have to make the hot melt layer in the same thickness range? Accordingly, one must also find a way to apply an extremely thin layer of hot melt material on the silicon wafer and study whether such layer can provide a good seal around a liquid fuel cell.

When there are many questions to be answered, there would be no incentive for one skilled in the art to use some material suitable for a macro-scale fuel cell such as that disclosed in *Nagayama*, in a micro-scale fuel cell such as that disclosed in *Fujii*.

Furthermore, claim 2 is dependent from claim 1 and recites features not recited in claim 1. For reasons regarding claim 1 above, claim 2 is distinguishable over the cited *Fujii* and *Nagayama* references.

At section 7, claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Fujii*, in view of *Morse* (U.S. Patent No. 6,960,403) or Arroyo (U.S. Patent Application Publication No. 2005/0019635).

It is respectfully submitted that claims 3 and 4 are dependent from claim 1 and recite features not recited in claim 1. For reasons regarding claim 1 above, claims 3 and 4 are also distinguishable over the cited *Fujii*, *Morse* and *Arroyo* references.

At section 9, claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Fujii*, in view of *Pratt* (U.S. Patent No. 6,127,058).

It is respectfully submitted that claim 11 is dependent from claim 5 and recites features not recited in claim 5. For reasons regarding claim 5 above, claim 11 is also distinguishable over the cited *Fujii* and *Pratt* references.

CONCLUSION

Claims 1-21 are allowable. Early allowance of all pending claims is earnestly solicited.

Respectfully submitted,

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